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6 ANNUAL TECHNICAL REPORT ON CONTRACT N00014-76-C-1041

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Lead loaned to this Department under Contract #N00014-76-C-1041 is used to counterweight the 60 foot diameter radio telescope at Derwood, Maryland. This apparatus serves as a research instrument, a test device for new equipment development, and as a teaching aid.

A search for very high velocity clouds of neutral hydrogen at all Galactic latitudes and longitudes visible from the Northern Hemisphere over a velocity range of -800 to +800 kms^{-1} is continuing.[1]

We are currently working on the development of a completely new 21 cm receiver for the Instituto Argentina de Radioastronomía, funded in part by NSF Grant #01P75-19069, which will require the use of this telescope for the extensive testing necessary. We are also modifying our 1.3 cm receiver which will be used to study the continuum emission from our Galaxy, new studies of hydrogen recombination lines and H_2O maser variability studies.

As an educational aid, the telescope has been used in the fall of 1975 and is in use this fall by astronomy students at the University of Maryland, who thus gain actual "hands on" experience in making their own radio astronomical observations, an opportunity very difficult to find anywhere else. The enthusiastic response of the students and their instructors

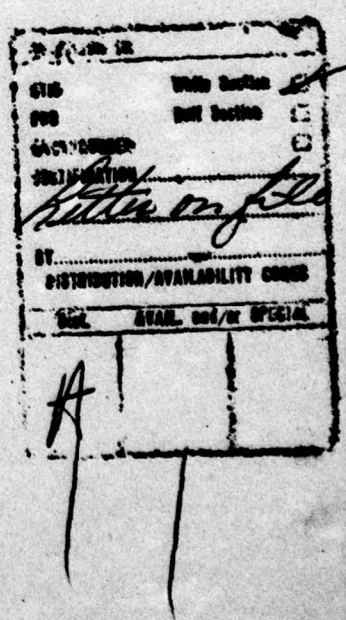
make us pleased to continue to provide this service.

George W. Wetherill

George W. Wetherill
Director

References

1. Tuve, M. A., C. A. Little, and E. T. Ecklund, Carnegie Institution of Washington Year Book 74, p. 131, 1975.



Merle A. Tuve, Charles A. Little, and Everett T. Ecklund

A cumulative search has continued through the year for hydrogen clouds of very high velocities of approach, which might be clouds from outer space "falling" into our Galaxy, or, conversely, clouds of very high velocities of recession, if they are explosively expelled in some way from, for example, the center of our Galaxy. As indicated in the Report for last year, a routine was established for searching selected sky points from zero velocity to −800 km/sec and from zero to +800 km/sec. A 53-channel receiver is used, modified to give each channel a velocity width of 16 km/sec (to half-power points) and spaced by 16 km/sec. The 60-foot parabolic antenna has a half-power width of 0.87° on the sky.

Observations are made at even 10° intervals in galactic longitude from 0° through 350°. At each longitude, observations are made at galactic latitudes 00°, 04°, 08°, 12°, 20°, 24°, 28°, 40°, [illegible] negative latitudes. Thus, 21 sets of observations are made for each galactic longitude for which the listed points rise above the horizon. Of 756 possible points, about 580 rise above the horizon at this latitude, and about 540 of these had been observed by May 1975. For each sky point four runs are made, two receding and two approaching. Each run is the average of three independent integrations of 80 seconds each on each channel. The overall receiver noise temperature is a bit high (about 300°K) in average runs, and the tuning curve of the parametric amplifier and other receiver circuits varies some from day to day (or hour to hour, if adjustments are made). From critical inspection one concludes that a diffuse cloud of great velocity spread (say 200 or 400 km/sec) would fail to be identified if its emission raised the antenna temperature only ½° or 1°K; it would simply appear to be a modest change in curvature of the base line. However, a cloud of moderately wide velocity spread (150 km/sec or less) would show as a distinct bulge in the (curved) base line if it contributed ~ 3°K to the antenna temperature. Careful examination of hundreds of records indicates that a cloud of small velocity spread, ~ 50 km/sec or less, would clearly be noticed if it gave rise to an antenna temperature of ½°K or more.

To date, no confirmed example of such a cloud has been found. A list of about 20 suspected examples remains for re-examination among the many small deviations in the routinely observed curves, which have been studied and repeated. It should also be noted that a small accumulation of neutral hydrogen on one side of the Galaxy, swept up by galaxy motion through a very low density of neutral hydrogen in outer space (if such exists) would not be detected if it gave rise to an antenna temperature of only a few degrees, because other effects, such as antenna "spillover" (maximum 8°K) [illegible] level.

It thus appears from our modest survey that hydrogen clouds from outer space falling toward our Galaxy are not a conspicuously frequent occurrence in space, and clouds expelled from our Galaxy at high velocities are also hard to find, if they exist.

REFERENCE 1.

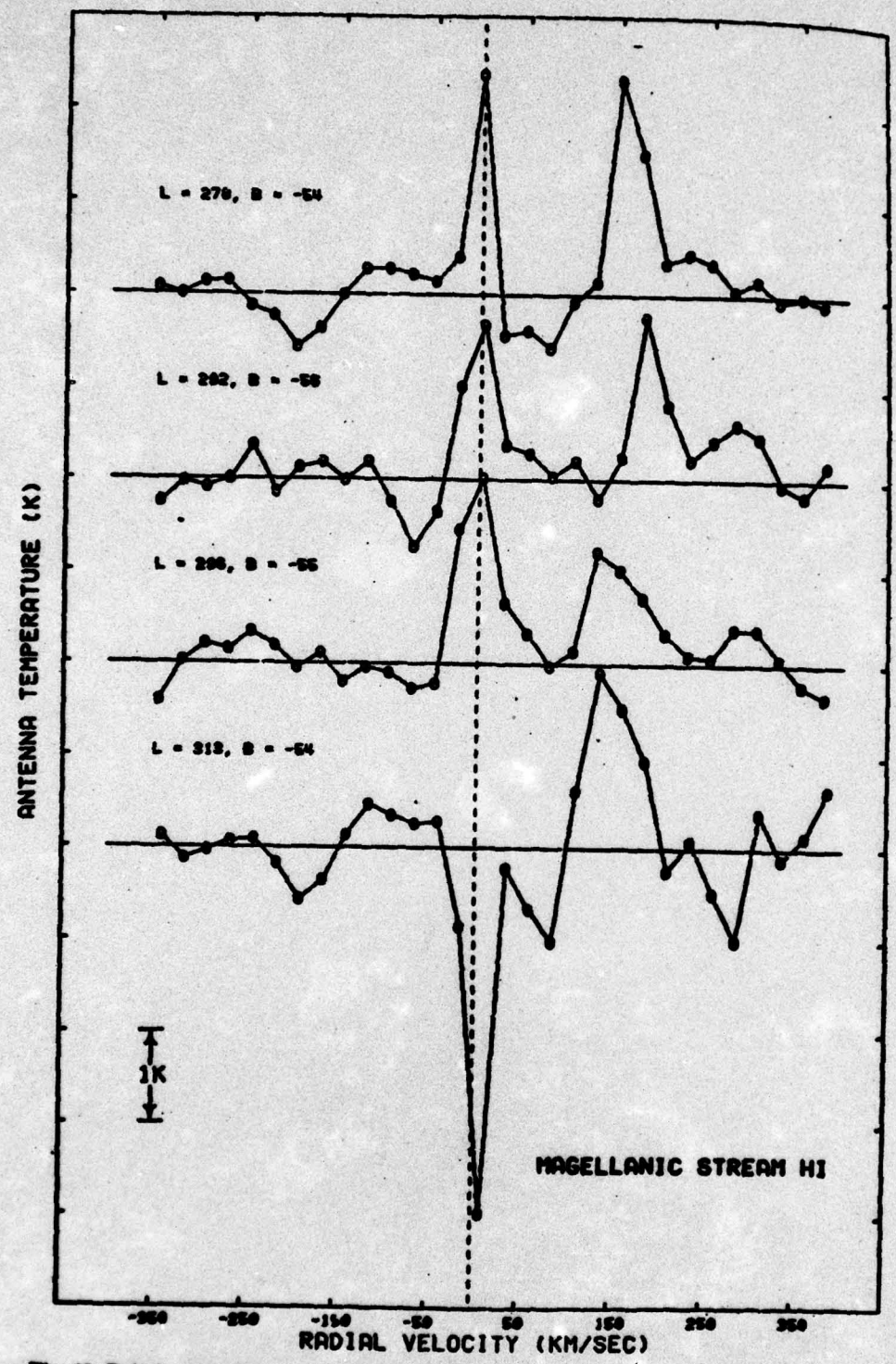


Fig. 12. Relative spectra of Magellanic Stream neutral hydrogen (cold sky reference spectrum has been subtracted). Deviations from zero near zero velocity represent changes in the amount of local hydrogen between the stream point and the reference point. Stream gas velocity is near 175 km/sec in the local standard of rest.